

## Retailer Energy Alliance: LED Refrigerated Display Case Performance Specification



Lighting and Controls Supplier Summit  
Las Vegas, Nevada  
May 11, 2010

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- REA Working Group kick-off meeting September 2009
- Coordination with energy-efficiency group/utility reps as well as product manufacturers
- Specification development
  - First draft released November 2009
  - Numerous iterations through April 2010
  - Final specification released May 2010
- DOE SSL Gateway demonstration report available (Albertsons in Eugene, Oregon)

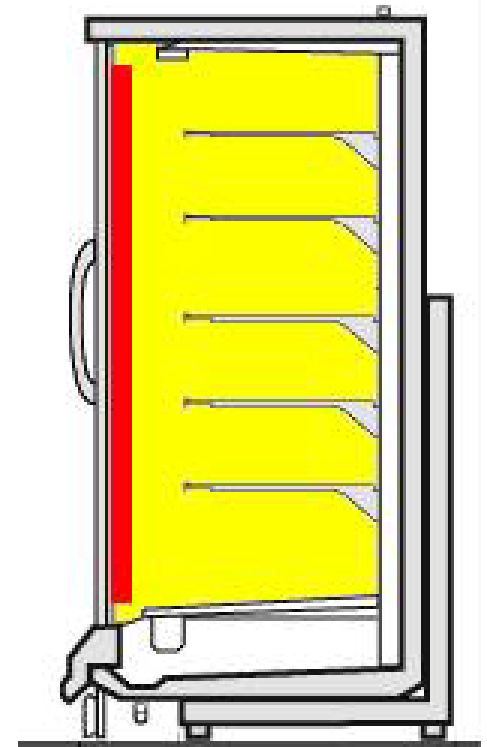
Working Group  
members include:



**Commercial Building**  
Energy Alliances

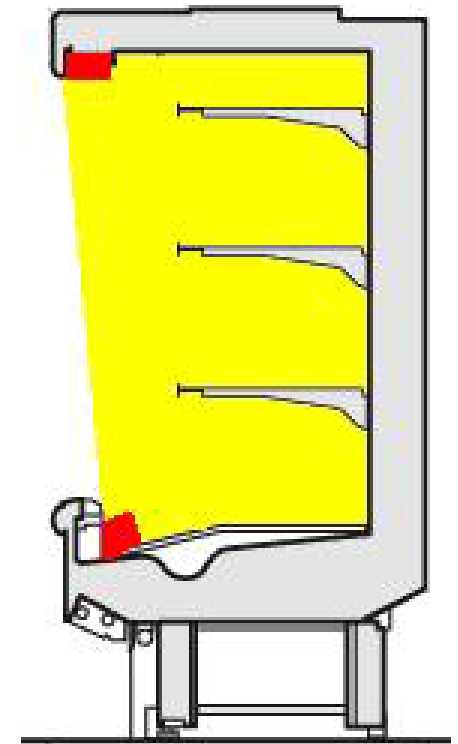
- Save energy
  - Efficiency levels consistent with utility incentives
- Produce acceptable quantity and quality of illumination
- Ensure maintained performance
- Minimize added system cost
- Allow for customization of *template* by each retail partner
- Streamline the submittal review process

- Applies to retrofit and new cases
  - Enclosed by glass doors, i.e., “vertical”
    - Symmetric on middle mullions (T8 x 1)
    - Asymmetric at ends of case (T8 x 1)



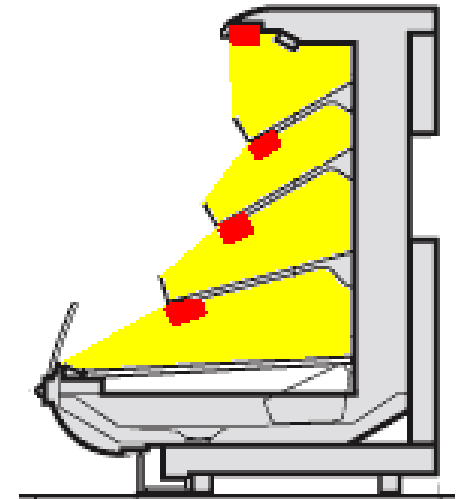
**Commercial Building**  
Energy Alliances

- Applies to retrofit and new cases
  - Open case with horizontal luminaires
    - Downlight in canopy (T8 x 2-3)
    - Optional uplight in nose (T8 x 1)



**Commercial Building**  
Energy Alliances

- Applies to retrofit and new cases
  - Open case with horizontal luminaires
    - Under canopy (T8 x 1-2)
    - Under shelf (T8 x 1)





- Installing contractor must certify coordination with lighting supplier and case manufacturer
  - Luminaires and drivers must be suited to their environment
- Warranty covers lumen and color maintenance
- Driver may be integral or remote
- Motion-sensor-controlled dimming is optional
- Power monitoring is recommended

- Specification consists of a Word document and supporting Excel spreadsheets
- Document contains
  - General requirements and references to standards
  - Items subject to visual (subjective) approval by owner
    - Uniformity
    - Color quality
    - Flicker
    - Glare
- Spreadsheets contain
  - Customized values for each criterion
  - Submittal forms for each product type



lumen maintenance	95%	% of initial output after 6,000 hours (per Appendix A)
color maintenance	0.007	$\Delta u^*v^*$ after 6,000 hours
	5	warranty (years)
	80%	recyclable by weight
	54	ingress protection (IP) rating for secondary optical chamber
distribution	90%	% of lumens in quarter-sphere
	95%	% of lumens in hemisphere
enclosed cases	2	ratio between middle and end luminaires for output and wattage
projection from mounting surface	2.5	inches max projection for END, MIDDLE, CANOPY, NOSE luminaires
	1	inch max projection for OVER-SHELF luminaires
power	120	line voltage
	120	Hz minimum frequency of driver output
	0.90	PF at full output
	10%	THD at full output
dimming	0.80	PF when dimmed
	20%	THD when dimmed
	40%	reduction of wattage when dimmed
	1	seconds maximum for lower fade duration limit (freedom to set at rapid fade rate)
	5	seconds minimum for upper fade duration limit (freedom to set a slow fade rate)
occupancy/motion sensor	20%	sensor pattern overlap
	30	seconds maximum for lower time delay limit (freedom to increase sampling rate)
	30	minutes maximum for upper time delay limit (prevents wasted energy)
	2	minutes maximum increment for time delay setting (provides flexibility)

	Nominal CCT (K) <sup>1</sup>				CRI	R9	R10,R11,R12	R(9-12)
	Target	Tolerance	Minimum	Maximum				
Meat display	2850	± 150	2700	3000	70	50	0	50
Other	4100	± 200	3900	4300	70	0	0	50
	Error?	Message						

- ☐ Tolerance must be zero or be evenly divisible by 50.
- ☐ Nominal CCTs must be evenly divisible by 100.
- ☐ Nominal CCTs must be between 2700K and 6500K.

door			canopy		nose	shelf	
4	5	6	2-lamp	3-lamp	4	4	
2950	5200	6300	2950	2950	2950	2950	ft nominal lamp length
0.87	1.00	1.00	0.87	0.87	0.87	0.87	initial rated lumens
55	58	70	55	55	55	55	ballast factor
1	1	1	2	2	1	1	ballast input W
55	58	70	27.5	27.5	55	55	lamps per ballast
1	1	1	2	3	1	1	W ballast input per lamp
55	58	70	55	83	55	55	lamps in luminaire cross-section
75%	75%	75%	75%	75%	75%	75%	W in cross-section
60%	60%	60%	60%	60%	60%	60%	approximate T8 output at 7°C
87%	87%	87%	87%	87%	87%	87%	forward efficiency
251	407	411	502	754	251	251	lumen depreciation at end of life
75%	75%	75%	75%	75%	75%	75%	maintained forward lumens per foot
70%	70%	70%	70%	70%	70%	70%	reduction allowed by improved uniformity
105%	105%	105%	105%	105%	105%	105%	EOL LLD for SSL
257	417	421	515	772	257	257	approximate increase for LED at 10°C
260	420	420	510	770	260	260	required initial lm/ft for SSL at 25°C
13.8	11.6	11.7	13.8	20.6	13.8	13.8	specified lm/ft
15%	15%	15%	15%	15%	15%	15%	W/ft floor.
2.1	1.7	1.8	2.1	3.1	2.1	2.1	required ltg W reduction
11.7	9.9	9.9	11.7	17.5	11.7	11.7	W/ft lighting reduction
102%	102%	102%	102%	102%	102%	102%	max input W/ft at 10°C
11.5	9.7	9.7	11.5	17.2	11.5	11.5	approximate increase for LED at 10°C
22	43	43	45	45	22	22	max input W/ft at 25°C
22	43	43	45	45	22	22	required lm/W
11.8	9.8	9.8	11.3	17.1	11.8	11.8	specified lm/W
3.0	3.0	3.0	3.0	3.0	3.0	3.0	specified max W/ft
0.7	0.6	0.6	0.7	1.0	0.7	0.7	ratio of lighting to refrig savings
19%	21%	21%	23%	22%	19%	19%	W refrig reduction
							net reduction

# Submittal Forms – Luminaires

## LUMINAIRE SUBMITTAL FORM

Note: See project specifications for additional requirements.

Type: **MSE**

Category: MIDDLE (located on mullion between doors)

Length: 5 nominal feet

Driver: ☐ Integral to luminaire housing  
☒ External to luminaire housing

Meat Display: ☐

Notes:

Attached: ☐ Cut-sheet(s)  
☐ Installation instructions  
☐ LM-79 report(s)  
☐ LM-80 report  
☐ Device reliability data  
☐ Recyclability data

Catalog #

☐ UL listed/certified for this application  
☐ NSF compliant  
☐ RoHS compliant

Spec Item	Description	Submitted	Required	Complies
Light Output	Initial lumens		≥ 2100	<input type="checkbox"/>
	Lumens per nominal foot (lm/ft)	0	≥ 420	<input type="checkbox"/>
Power Consumption	Without Driver Losses (W)			
	Worst-case Driver Configuration (W)	0.0	≤ 49.0	<input type="checkbox"/>
	Watts per nominal foot (W/ft)	0.0	≤ 9.8	<input type="checkbox"/>
Efficacy	lm/W	0	≥ 43	<input type="checkbox"/>
Stray Light	% of lumens in hemisphere		≥ 95%	<input type="checkbox"/>
Source Color	Nominal/catalogued CCT (K)		≥ 3900 ≤ 4300	<input type="checkbox"/>
	LM-79 measured CCT (K)		= ±	<input type="checkbox"/>
	Duv		= ±	<input type="checkbox"/>
Color Rendition	CRI or Ra		≥ 70	<input type="checkbox"/>
	R9		≥ 0	<input type="checkbox"/>
	Lowest value among R10, R11 & R12		≥ 0	<input type="checkbox"/>
	Average R(9-12)		≥ 50	<input type="checkbox"/>
	Compliance Option		= 1 or 2	<input type="checkbox"/>
Lumen Maint.	Drive current (mA)		≥	<input type="checkbox"/>
	TMPLED at 25°C ambient (°C)		≤	<input type="checkbox"/>
	% of initial output after 6,000 hours		≥ 95%	<input type="checkbox"/>
Color Maint.	Δu'v' after 6,000 hours		≤ 0.007	<input type="checkbox"/>
Warranty	Parts and labor warranty (years)		≥ 5	<input type="checkbox"/>
Size	Max projection (inches)		≤ 2.5	<input type="checkbox"/>
Recyclability	% recyclable by weight		≥ 80%	<input type="checkbox"/>
Cleaning	Ingress protection (IP) rating		≥ 54	<input type="checkbox"/>

# Submittal Forms – External Drivers

## EXTERNAL DRIVER SUBMITTAL FORM (1 of 2)

Note: See project specifications for additional requirements.

Type: **D1**

Driver: ☒ External to luminaire housing (remote)

Capacity: 0 W

Dimming: ☒

Notes:

- Attached:
- ☐ Cut-sheet(s) Catalog #
  - ☐ Installation instructions
  - ☐ Diagram of driver efficiency as a function of output power
  - ☐ Device reliability data
  - ☐ Recyclability data
  - ☐ Written assurance from installing contractor that TMP is not exceeded

- Certifications:
- ☐ UL listed/certified for this application
  - ☐ NSF compliant
  - ☐ RoHS compliant

Description	Submitted	Required	Complies
Maximum output (W)	0	≤	<input type="checkbox"/>
Minimum output (W)	0	≥	<input type="checkbox"/>
Line voltage (V)		= 120	<input type="checkbox"/>
Driver output frequency (Hz)		≥ 120	<input type="checkbox"/>
Power Factor at full output		≥ 0.90	<input type="checkbox"/>
THD at full output		≤ 10%	<input type="checkbox"/>
Wattage reduction when dimmed (%)		≥ 40%	<input type="checkbox"/>
Power Factor when dimmed		≥ 0.80	<input type="checkbox"/>
THD when dimmed		≤ 20%	<input type="checkbox"/>
Parts and labor warranty (years)		≥ 5	<input type="checkbox"/>

# Submittal Forms – External Drivers

EXTERNAL DRIVER SUBMITTAL FORM (2 of 2)								
Note: See project specifications for additional requirements.								
Type: D1		Configuration						
		A	B	C	D	E	F	G
Luminaire	w/o losses	# Luminaires Sharing Driver						
M5E	0							
E5E	0							
M6E	0							
E6E	0							
C4E	0							
C4E3	0							
N4E	0							
O4E	0							
O4EM	0							
		0	0	0	0	0	0	0
		0	0	0	0	0	0	0
		0	0	0	0	0	0	0
		0	0	0	0	0	0	0
		0	0	0	0	0	0	0
		0	0	0	0	0	0	0
		0	0	0	0	0	0	0
		0	0	0	0	0	0	0
		0	0	0	0	0	0	0
Output Power		0	0	0	0	0	0	0
Efficiency								
Total Input Power		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Capacity Not Exceeded		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Luminaire	Max W	Driver Input Power by Luminaire Type						
M5E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E5E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
M6E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
E6E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C4E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C4E3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N4E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
O4E	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
O4EM	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Configuration						
		A	B	C	D	E	F	G
Instances								

# Submittal Forms – Motion Sensors

OCCUPANCY/MOTION SENSOR SUBMITTAL FORM				
Note: See project specifications for additional requirements.				
<p>Type: <b>S1</b></p> <p>Low-voltage: <input checked="" type="checkbox"/> Power pack required</p> <p>Notes: <div style="background-color: #d9e1f2; height: 30px; width: 100%;"></div></p> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <p>Attached:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Cut-sheet(s) for sensor</li> <li><input type="checkbox"/> Cut-sheet(s) for power pack</li> <li><input type="checkbox"/> Installation instructions</li> <li><input type="checkbox"/> Device reliability data</li> <li><input type="checkbox"/> Recyclability data</li> </ul> </div> <div style="width: 45%;"> <p>Catalog # <div style="background-color: #d9e1f2; height: 20px; width: 100%;"></div></p> <p>#### <div style="background-color: #d9e1f2; height: 20px; width: 100%;"></div></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> UL listed/certified for this application</li> <li><input type="checkbox"/> RoHS compliant</li> </ul> </div> </div>				
Spec Item	Description	Submitted	Required	Complies
	Coverage patterns overlap		≥ 20%	<input type="checkbox"/>
	Minimum time delay (seconds)		≤ 30	<input type="checkbox"/>
	Maximum time delay (minutes)		≤ 30	<input type="checkbox"/>
	Time delay increment (minutes)		≤ 2	<input type="checkbox"/>
	Line voltage (V)		= 120	<input type="checkbox"/>
	Parts and labor warranty (years)		≥ 5	<input type="checkbox"/>
	Minimum fade duration (seconds)		≤ 1	<input type="checkbox"/>
	Maximum fade duration (seconds)		≥ 5	<input type="checkbox"/>

- Retailer implementation of the specification
- Experiences will be shared among partners and communicated to suppliers
- Shared expectations will help inform industry standards
- The template specification itself will evolve as needed



- Retailer Energy Alliance (REA)
  - [commercialbuildings.energy.gov/retailer](https://commercialbuildings.energy.gov/retailer)
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